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Noise abatement zones: Part 1

The Control of Pollution Act 1974 (Chapter 40)[1] *together with the associated regulations*[2][3] *empowers local authorities to introduce noise abatement zones for the control of noise. The Department of the Environment Circular 2/76*[4] *states: '. . . Noise abatement zones will be areas designated by local authorities within which it will be possible to control noise from classified premises by establishing the current noise levels and using these as reference levels for control of noise from premises in the future'. The technical aspects of the regulations are based largely on investigations carried out by the Building Research Establishment.*

This digest discusses the function of noise abatement zones and suggests appropriate methods of noise measurement for setting up and implementing them. An essential feature is the keeping of a noise level register to record the noise output of classified premises within the designated zone. The register forms the basis for future monitoring and control, and ultimately for abatement.

The digest gives introductory guidance for local authorities and for owners and managements of factories and other noise-producing premises; it may also be useful to architects and designers of projected noise-producing premises subject to zone control. It is published in two parts: Part 1 discusses some of the background to noise abatement zones, the noise level register and noise control boundaries, and Part 2 gives details of the methods of measuring and calculating noise levels.

It is widely acknowledged that noise has become a distressing pollutant of the environment and that means to control it are urgently needed. Much has already been done on a national scale to limit the impact of noise from transport, such as aircraft and road traffic, and the general laws of nuisance may be invoked to inhibit other disturbing noises. But noise sources are legion and cannot be avoided altogether because they are a consequence of meeting many vital needs of society. Nevertheless, some noise control is essential if the well-being of society as a whole is not to be undermined.

Prepared at Building Research Station, Garston, Watford WD2 7JR
Technical enquiries arising from this Digest should be directed to Building Research Advisory Service at the above address.

Co-operation at many levels is necessary to achieve a satisfactory balance between freedom and restraint. Industrial noise in particular is so varied a problem that it is not amenable to central control alone but calls for local involvement as well. Central Government has taken the first step through the recent Act[1] and accompanying Regulations[2][3] which enable local authorities to set up noise abatement zones (see Part III of the Act, Sections 63–67, and Schedule 1) as they think necessary or desirable, consistent with their available resources for applying the controls efficiently. Individual local authorities are not obliged to establish noise abatement zones but they are encouraged to do so as far as their technical and financial means permit. The objective is initially to prevent worsening of the present noise climate and ultimately to reduce environmental noise where desirable and practicable. Hence the term 'noise *abatement* zone'. Zones may cover the whole or part of the local authority's district, areas of mixed residential and industrial occupation being particularly suitable for zoning. They come into force by the promulgation of noise abatement orders; such orders are not immutable and may be modified at any time in the light of experience, though, it is suggested, with due regard to the administrative work involved. Indeed, the local authority may wish to designate a pilot zone in the first place, to gain experience of operating a zone.

Noise abatement zones

Noise abatement zones are those areas which the local authority may determine should be subject to a special degree of noise control. They are inaugurated by 'noise abatement orders' defining the zone boundaries (by map if necessary) and classifying by function the types of premises within the zone which will be liable to noise control. Existing individual premises of the classified types will then be identified and listed and the respective owners and occupiers notified. The noise output of each of these premises is measured at selected points along a 'noise control boundary', normally the site boundary of the premises, and the measured levels entered in a 'noise level register' kept by the local authority. This register will be the statutory basis of future noise control of the various premises, and thereafter the noise will be monitored as necessary. The choice of the broad functional classes of fixed premises to be included in any noise abatement order rests with the local authority but the following list is offered as a guide:—

Industrial premises (factories, workshops etc.);
Commercial premises (warehouses, garages, offices, shops, hotels etc);
Places of entertainment (theatres, bingo halls, discotheques, stadia etc);
Agricultural premises (farms, crop-drying plant, kennels etc);
Transport installations (railway stations, bus garages, wharves, locomotive or aircraft repair shops, container bases etc);
Public utility installations (power stations, transformer sub-stations, waterworks, gasworks, coal mines etc).

It may not be necessary for all premises falling under these categories to be included in the noise register. Many offices and shops have no significant noise sources within them, though others may be potentially noisy. Similarly, some farms may have extensive areas of land around their fixed plant, resulting in no significant noise at their boundaries. Domestic property should not be classified in noise abatement orders because any noise will be of a transient nature best dealt with under the nuisance sections (eg 58–59) of the Act. Construction sites are also unsuitable as classified premises because their noise is transient; sections 60–61 of the Act specifically relate to them.

Planning applications for new buildings, extensions or alterations of a classified type within a noise abatement zone should be carefully assessed with regard to potential noise and approval should be subject to specified noise maxima at their boundaries. These maxima are at the discretion of the local authority, after due consideration of all the factors involved but normally should be chosen so as to prevent an increase in existing levels in the neighbourhood. The earliest opportunity should be taken after the premises are in operation to measure the actual noise output and to record the results in the register. The applicants should be warned at an early design stage of the noise standards they will have to meet, and noise control measures to ensure conformity should be discussed at that stage.

Noise level register

When a noise abatement order has been made designating a noise abatement zone, the local authority is committed to measure the noise from classified premises in the prescribed manner and to keep a noise level register, open to public inspection, recording the measured levels and all relevant particulars. It is recommended that the register contains a block plan of each premises showing the positions along the noise control boundary at which the measured levels were obtained, accurately located and numbered for identification, together with a chart of the numbered points giving the noise levels in dB(A) and comments as necessary. The register should be precise and accurate, as it is the basis of all subsequent statutory control of noise from the premises. For this reason also, all the measured levels should, as far as possible, be agreed with the owners and occupiers of the premises before being entered in the register, and each should be sent a copy of the entries which concern him. He is then allowed 28 days in which to appeal to the Secretary of State, who will confirm or amend the entries. The validity or accuracy of the records cannot thereafter be questioned, though as a policy matter the levels may be amended later if all parties agree.

Noise control boundaries

The 'noise control boundary' relates to the particular premises measured for noise and should not be confused with the zone boundary: it is the line bordering the premises along which the measuring points are located. Wherever practicable, the noise control boundary should be at the perimeter of the site belonging to the premises. Measurements are simplified where the perimeter adjoins open land and is bounded by an open fence. Measuring points are selected along this boundary on the basis suggested below, preferably with the microphone at a standard height of 1.2 m above ground. Conditions may, however, necessitate variations from this procedure, as discussed later.

In planning the noise survey of particular premises, considerable judgement is called for on the part of the measuring team. Some of the complexities will emerge later but to illustrate at this point the basic approach it is assumed that the premises mainly comprise factory buildings with noise sources housed within them; thus effectively the building surfaces will act as fixed noise sources though there may be some unenclosed sources, such as plant on a roof.

The first step is to establish the noise control boundary. Difficulties of measurement at some locations need to be taken into account but the boundary will normally coincide with any part of the site perimeter where there is open ground on both sides or where an open site adjoins low buildings outside the site. Where the site is built on up to

the perimeter, but adjoins open ground, the control boundary may be moved a convenient distance outside the perimeter, provided the ground is public or its owner is willing to co-operate. A similar shift of control boundary, but within the site, may be made when the site itself is open but adjoins a high neighbouring building at its perimeter.

A common problem arises where a dwelling adjoins classified premises, for example a factory, and is separated from it by a party wall. A noise source in the factory can cause an increase in level in the dwelling which would not be detected by measuring the noise either from outside the dwelling or within the factory. Thus, despite the problems of obtaining accurate reproducible measurements of noise level in small rooms, there would be advantages in registering the factory generated noise level within the dwelling itself.

Measurement points

The distribution of measuring points along the noise control boundary is the next step. A block plan of the premises drawn to scale is essential for this purpose. The basis for determining microphone positions is that the whole face of each building on the site is to be regarded as a potential noise source (together with any isolated sources) and should be contained within a certain angle from a measuring point. This is shown diagrammatically in Fig 1, where the dotted line is the main axis of the microphone and the angle of coverage on each side of the axis is marked θ. It is suggested that θ should not be more than 65° and need not be less than 45°. An angle of 45° will require twice as many measuring points as an angle of 65°. The angle used does not have to be constant along the whole noise control boundary if all sections do not require equally rigorous control; but all measuring positions must be clearly defined for future monitoring, as these positions are crucial to the system of control and underlie its statutory basis. They should be accurately marked on the plan, supplemented if necessary by a description, perhaps in relation to some feature of the building.

It is possible that measurements at particular points may be affected by standing-wave patterns due to dominant pure tone (ie single-frequency) components. These are characteristically indicated by appreciable variations in noise level over short steps in distance. It is important to identify standing-wave situations, as the pattern may vary from time to time and cause the level at a fixed position to change even when the power output of the source remains unchanged. When

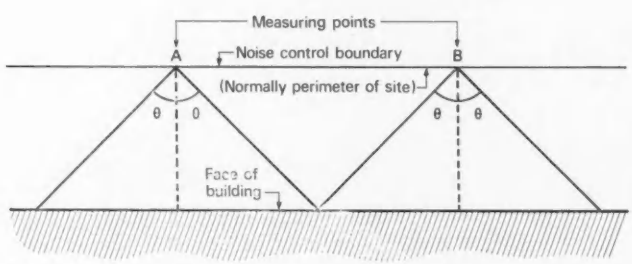

Fig 1 Geometric basis of measuring points

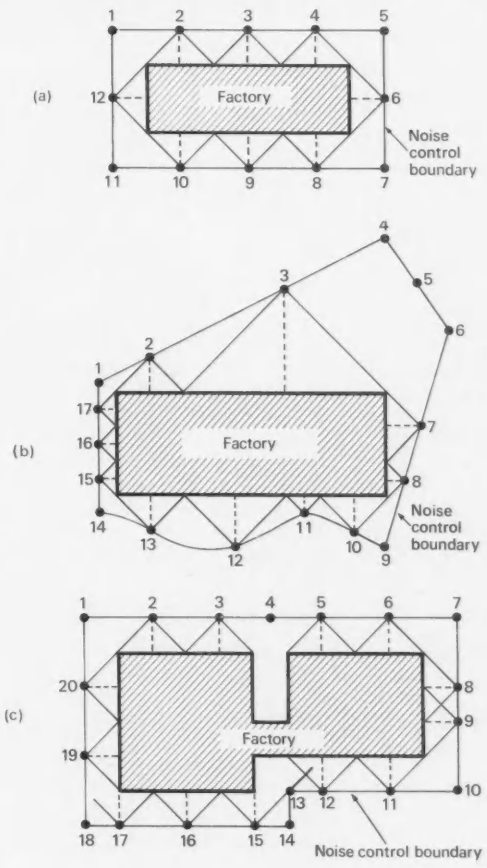

Fig 2 Noise control boundaries and microphone locations

standing-wave patterns are encountered the level at the measuring point should be supplemented by sampling along the boundary to the next measuring point on each side and recording the maximum levels observed on both sides.

Three simple examples of factory block plans are shown in Fig 2, with measuring points located to indicate the application of the measuring system suggested, designed in each case on a rigorous basis with θ angles of 45°. In Fig 2 (a), supplementary points are located at the four corners of the site; these are advisable because together they cover the areas of open site where future noise sources may be placed; Fig 2 (b) shows supplementary points at the five site corners, with another at position 5, all intended to anticipate any additional building or fixed noise source within the large free area of the site.

In Fig 2 (c), in addition to the corner points there is a supplementary point at position 4 to cover noise from the recessed portion of the building; point 13 serves a similar purpose. Points 8 and 9 have overlapping fields but both are necessary for θ 45° coverage; they could however be resolved into a single point if $\theta = 60°$ were considered adequate for this face of the building, which already has some coverage at each end from points 7 and 10.

A different situation is presented by a factory building in a built-up area occupying the whole site of a block bordered by streets, as illustrated in Fig 3. Since it is not feasible for the noise control boundary to coincide with the boundary of the premises it has been set back by the width of the pavement. In this example it has been deemed sufficient to employ a coverage angle of 60–65°, but account must be taken of any dominant noise sources along the perimeter of the premises, such as ventilation or cooling equipment, doors and windows; if a regular layout allows some of these sources to occur near the extremities of the angles of coverage, the angle θ should be varied along the frontage to bring the measuring positions closer to the sources. If one face of the premises presents a blank wall, it would still be desirable for control purposes to measure the existing levels along it (even though only extraneous noise is measurable at present) in case of future openings or other noise sources from the premises on that frontage.

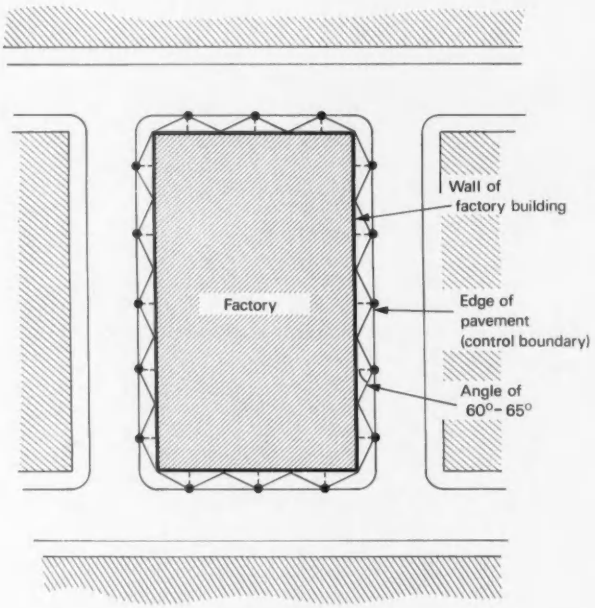

Fig 3 Classified premises occupying street block

Limitations

There are certain limitations of noise control from measurements made at the noise control boundary, although they do not invalidate the method. Apart from the practical difficulties of accurate measurement of variable noise at any point, two limitations particularly affect loud point sources.

The first concerns a point source within the premises at a distance x from a measuring point P on the noise control boundary. If the distance between the source and P is doubled by moving the source and the output is increased by 6 dB, there will be no increase in level at P because of distance attenuation. But at another point R, 2x from the original position of the source and 3x from its new position, the effect of moving the source and of increasing its level by 6 dB would be an increase at point R of 2.5 dB. This limitation is restrained to some extent because moving the source further away from one check point would bring it nearer to check points on the opposite boundary. But

the level at those other points might not be increased if moving the source brought it closer to a building which gave additional screening at those points. For these reasons the position of prominent sources (especially movable point sources) should be carefully noted when the noise control survey is made, so that the effect of subsequent changes may be considered at all locations within the noise abatement zone.

The second limitation occurs when the output of a significant source is increased but is shielded by a barrier to prevent an increase in level at the boundary. On level ground, the attenuation provided by the barrier will decrease with distance, so although the level at the boundary will not change, there may be an increase at points further away.

In the very few situations which may arise in which there is an increase in level at a dwelling with no corresponding increase in registered level, any complaints from residents can be dealt with under the nuisance provisions of the Control of Pollution Act. British Standard BS 4142[5] gives a method of rating the noise to assess the likelihood of such complaints.

Height of measurements

It has been suggested in cases of unobstructed sites that microphones should be at a standard height of 1.2 m above ground. The height should, however, be increased as necessary to clear sound-attenuating obstructions, such as walls, at the noise control boundary. Another

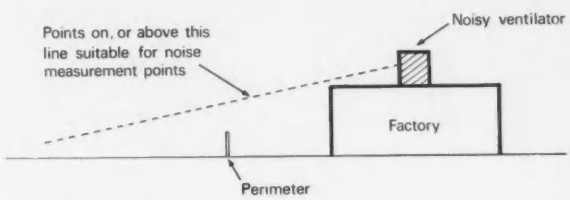

Fig 4 Sight line from microphone

case for raising the microphone occurs when the view of a principal noise source is shielded at the standard height by an obstruction within the site, say by the roof edge of a building, as shown in Fig 4. In this example, however, a possible alternative to raising the microphone would be to move the noise control boundary further out at that point so that an unobstructed view of the source is obtained at the standard height.

References and further reading

1 Control of Pollution Act 1974, Part III, Noise; HMSO
2 The Control of Noise (Measurement Registers) Regulations 1976, SI No 37; HMSO
3 The Control of Noise (Appeals) Regulations 1976, SI No 2116; HMSO
4 Control of Pollution Act 1974. Implementation of Part 3—Noise; DoE Circular 2/76; HMSO
5 BS 4142: 1967 Method of rating industrial noise affecting mixed residential and industrial areas; British Standards Institution
Noise levels at the boundaries of factories and commercial premises; BRE Current Paper CP 43/76

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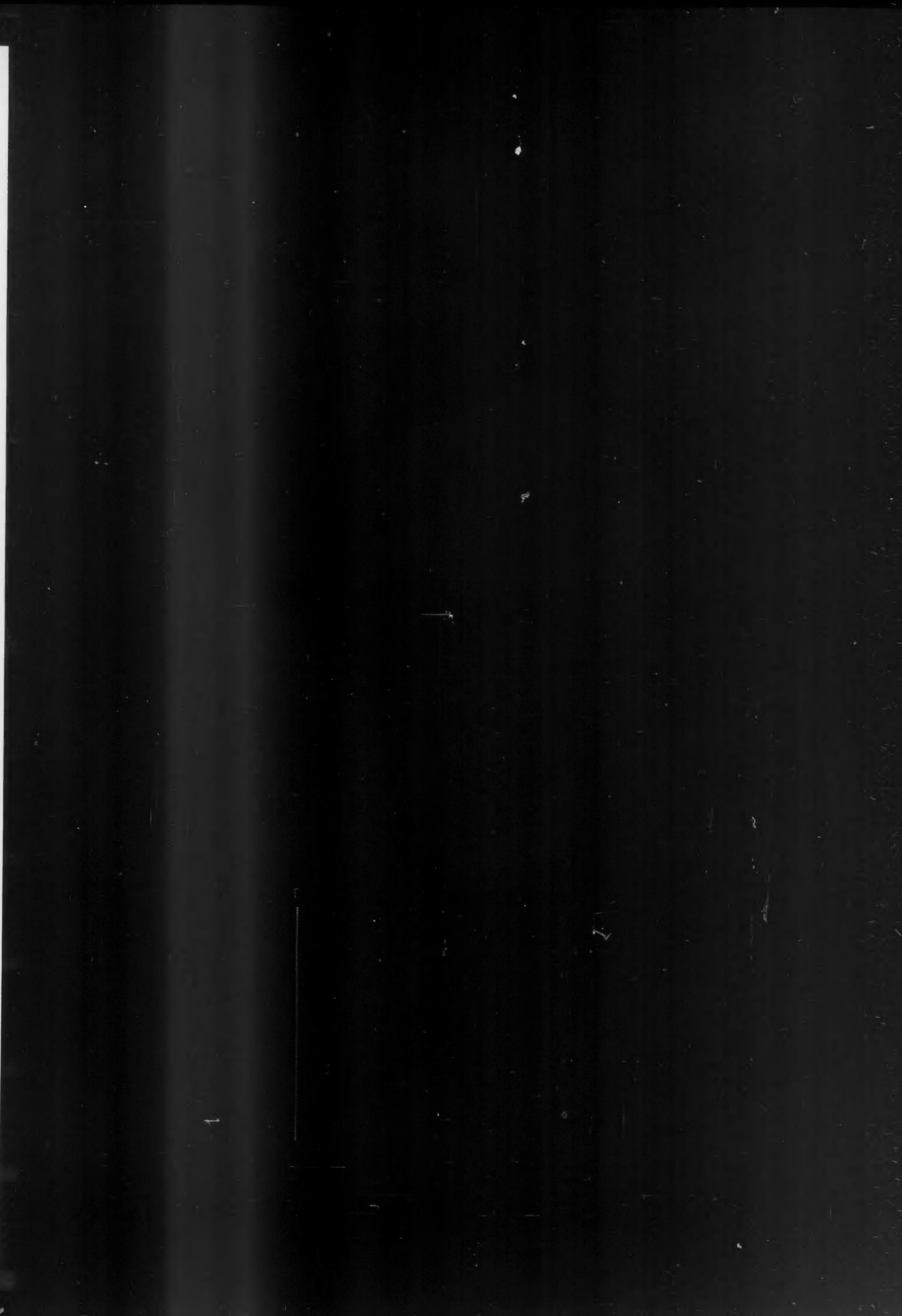
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